

IN THE CLAIMS:

1. A composition comprising:

- (a) (i) a quaternary ammonium biocide having the formula $N^+R^1R^2R^3R^4 X^-$,
(ii) a polymeric quaternary ammonium biocide, or
(iii) a mixture thereof; and
(b) (i) a ketone acid or salt thereof,
(ii) an aromatic carboxylic acid or a salt thereof, or
(iii) a mixture thereof,

wherein R^1 and R^2 are independently unsubstituted or hydroxy substituted linear or branched C_1 - C_4 alkyl, $-(CH_2CH_2O)_mCH_2CH_2OH$, or $-(CH_2CHCH_3O)_mCH_2CHCH_3OH$ where m is 1 to 10; R^3 is a substituted or unsubstituted benzyl, ethylbenzyl, methylnaphthyl, or linear or branched C_1 - C_{22} alkyl; R^4 is $-R^5(O)_n(C_6H_5)R^6$ where n is 0 or 1; R^5 is a substituted or unsubstituted C_1 - C_8 alkyl or C_1 - C_8 alkoxyalkyl; R^6 is hydrogen or a substituted or unsubstituted, linear or branched C_1 - C_{12} alkyl; and X^- is an anion.

2. The composition of claim 1, wherein R^5 is $-CH_2CH_2OCH_2CH_2-$.

3. The composition of claim 2, wherein R^4 is $[2-[2-(4\text{-diisobutylphenoxy})ethoxy]ethyl]$.

4. The composition of claim 1, wherein the quaternary ammonium biocide is a salt of benzethonium.

1 5. The composition of claim 4, wherein the quaternary ammonium biocide is
2 benzethonium chloride.

1 ✓ 6. The composition of claim 1, wherein R⁴ is benzyl.
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1 7. The composition of claim 1, wherein the quaternary ammonium biocide is a
2 salt of benzalkonium.

1 8. The composition of claim 7, wherein the quaternary ammonium biocide is
2 benzalkonium chloride.

1 9. The composition of claim ~~7~~, wherein the quaternary ammonium biocide is a
2 salt of (C₁₂-C₁₈) alkyl benzyl dimethyl ammonium.

1 10. The composition of claim 9, wherein the quaternary ammonium biocide is
2 (C₁₂-C₁₈) alkyl benzyl dimethyl ammonium chloride.

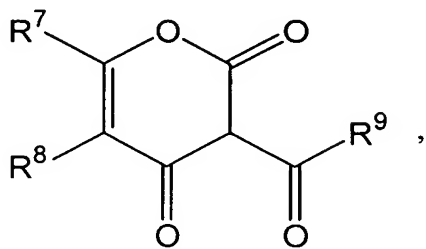
1 11. The composition of claim 1, wherein X⁻ is chloride or carbonate.

1 12. The composition of claim 11, wherein X⁻ is chloride.

1 13. The composition of claim 11, wherein X⁻ is carbonate.

1 14. The composition of claim 1, wherein the ketone acid is a cyclic ketone acid
2 or a salt thereof.

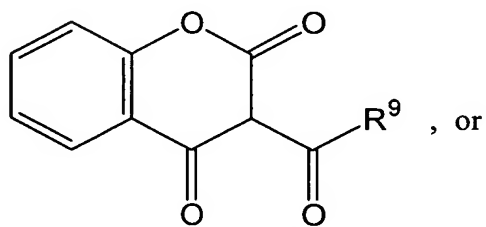
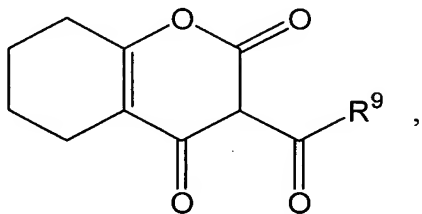
1 15. The composition of claim 14, wherein the cyclic ketone acid has the
2 formula

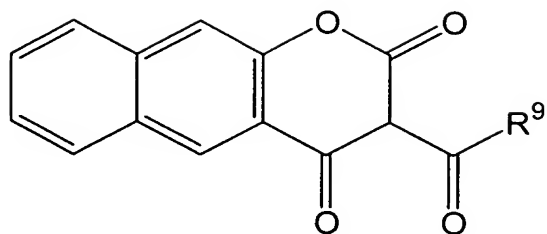


8 wherein R⁷, R⁸, and R⁹ are independently C₁-C₁₀ alkyl, C₁-C₁₀ alkenyl, C₁-C₁₀ alkenyl, aryl,
9 aryl substituted with halogen, or (C₁-C₁₀ alkyl)aryl.

10 16. The composition of claim 15, wherein R⁷, R⁸, and R⁹ are independently C₁-
11 C₄ alkyl; or R⁷ and R⁸ form a 5-12 member ring.

12 17. The composition of claim 15, wherein the cyclic ketone acid has the
13 formula





18. The composition of claim 14, wherein the ketone acid is dehydroacetic acid or a salt thereof.

19. The composition of claim 1, wherein the ketone acid is sodium dehydroacetate.

20. The composition of claim 1, wherein the ketone acid is encapsulated.

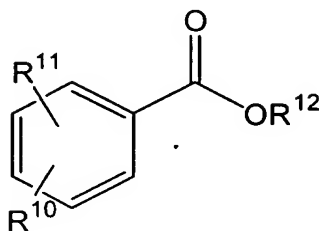
21. The composition of claim 18, wherein the dehydroacetic acid or salt thereof is encapsulated in cyclodextrin.

22. The composition of claim 1, wherein the quaternary ammonium biocide is benzethonium chloride and the ketone acid is dehydroacetic acid or a salt thereof.

23. The composition of claim 1, wherein the quaternary ammonium biocide is benzalkonium chloride and the ketone acid is dehydroacetic acid or a salt thereof.

24. The composition of claim 1, wherein the aromatic carboxylic acid is benzoic acid, derivative thereof, or salt thereof.

1 25. The composition of claim 1, wherein the aromatic carboxylic acid has the
2 formula



7 wherein R¹⁰ and R¹¹ are independently H, -OH, or -OC(O)CH₃; and R¹² is H, Na, K, Ca, or
8 Mg.

26. The composition of claim 1, wherein the aromatic carboxylic acid is a
hydroxy benzoic acid, derivative thereof, or salt thereof.

27. The composition of claim 26, wherein the hydroxy benzoic acid is salicylic
acid or a salt thereof.

28. The composition of claim 27, wherein the salt of salicylic acid is sodium
salicylate.

29. The composition of claim 1, wherein the quaternary ammonium biocide is
benzethonium chloride and the aromatic carboxylic acid is sodium salicylate.

30. The composition of claim 1, wherein the quaternary ammonium biocide is
benzalkonium chloride and the aromatic carboxylic acid is sodium salicylate.

31. The composition of claim 1, further comprising a solvent.

1 32. The composition of claim 31, wherein the solvent is water, an alcohol, a
2 glycol, an ester, an ether, a polyether or any combination of any of the foregoing.

1 33. The composition of claim 1, wherein the composition comprises a
2 biocidally effective amount of the quaternary ammonium biocide.

1 34. The composition of claim 1, wherein the composition comprises a
2 fungicidally effective amount of the quaternary ammonium biocide.

1 35. The composition of claim 1, wherein the weight ratio of the ketone acid to
2 the quaternary ammonium biocide ranges from about 0.00056:1 to about 1990:1.

1 36. The composition of claim 35, wherein the weight ratio of the ketone acid to
2 the quaternary ammonium biocide ranges from about 0.0056:1 to about 1400:1.

1 37. The composition of claim 1, wherein said composition comprises from
2 about 0.00005 to about 0.5% by weight of ketone acid and from about 0.00005 to about
3 0.45% by weight of quaternary ammonium biocide, based upon 100% weight of total
4 composition.

1 38. The composition of claim 37, wherein said composition comprises from
2 about 0.0005 to about 0.35% by weight of ketone acid and from about 0.0005 to about
3 0.2% by weight of quaternary ammonium biocide, based upon 100% weight of total
4 composition.

1 39. The composition of claim 1, wherein the weight ratio of the aromatic
2 carboxylic acid to the quaternary ammonium biocide ranges from about 0.00056:1 to about
3 1990:1.

1 40. The composition of claim 39, wherein the weight ratio of the aromatic
2 carboxylic acid to the quaternary ammonium biocide ranges from about 0.0056:1 to about
3 1400:1.

1 41. The composition of claim 1, wherein said composition comprises from
2 about 0.00005 to about 0.5% by weight of aromatic carboxylic acid and from about
3 0.00005 to about 0.45% by weight of quaternary ammonium biocide, based upon 100%
4 weight of total composition.

1 42. The composition of claim 41, wherein said composition comprises from
2 about 0.0005 to about 0.35% by weight of aromatic carboxylic acid and from about 0.0005
3 to about 0.2% by weight of quaternary ammonium biocide, based upon 100% weight of
4 total composition.

1 43. An antimicrobial composition comprising a synergistic mixture of:

2 (a) dehydroacetic acid or a salt thereof; and

3 (b) benzethonium chloride.

1 44. An antimicrobial composition comprising a synergistic mixture of:

2 (a) salicylic acid or a salt thereof; and

3 (b) benzethonium chloride.

1 45. A method of inhibiting the growth of microorganisms comprising applying
2 an effective amount of the composition of claim 1.

3 46. A preservative formulation comprising a synergistic mixture of:

4 (a) dehydroacetic acid or a salt thereof;

5 (b) a benzethonium salt; and

6 (c) salicylic acid or a salt thereof.

7 47. The preservative formulation of claim 46, further comprising:

8 (d) benzoic acid or a salt thereof;

9 (e) phenoxyethanol; and

10 (f) benzyl alcohol.

11 48. The preservative formulation of claim 47 comprising:

12 (a) from about 5 to about 40% by weight of dehydroacetic acid;

13 (b) from about 1 to about 20% by weight of benzethonium chloride;

14 (c) from about 2.5 to about 20% by weight of salicylic acid;

15 (d) from about 2.5 to about 20% by weight of benzoic acid;

16 (e) from about 20 to about 50% by weight of phenoxyethanol; and

17 (f) from about 5 to about 50% by weight of benzyl alcohol,

18 based upon 100% total weight of preservative formulation.

19 49. The preservative formulation of claim 48 comprising:

20 (a) about 10% by weight of dehydroacetic acid;

21 (b) about 5% by weight of benzethonium chloride;

22 (c) about 10% by weight of salicylic acid;

5 (d) about 10% by weight of benzoic acid;
6 (e) about 35% by weight of phenoxyethanol; and
7 (f) about 30% by weight of benzyl alcohol,
8 based upon 100% total weight of preservative formulation.

1 50. A composition comprising from about 0.01 to about 2% by weight of the
2 preservative composition of claim 48.